

PTO 06-6493

CY=JA DATE=19850308 KIND=A
PN=60-043480

CRUCIBLE AS EVAPORATING SOURCE FOR VACUUM DEPOSITION
[Shinkujochakuyo johatsugen rutsubo]

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UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. August 2006

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(19):	JP
DOCUMENT KIND	(12):	A
	(13):	PUBLISHED UNEXAMINED PATENT APPLICATION (Kokai)
PUBLICATION DATE	(43):	19850308 [WITHOUT GRANT]
PUBLICATION DATE	(45):	19850308 [WITH GRANT]
APPLICATION NUMBER	(21):	58-150194
APPLICATION DATE	(22):	19830819
PRIORITY DATE	(32):	
ADDITION TO	(61):	
INTERNATIONAL CLASSIFICATION	(51):	C23C 14/24
DOMESTIC CLASSIFICATION	(52):	
PRIORITY COUNTRY	(33):	
PRIORITY NUMBER	(31):	
PRIORITY DATE	(32):	
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TITLE	(54):	CRUCIBLE AS EVAPORATING SOURCE FOR VACUUM DEPOSITION
FOREIGN TITLE	[54A]:	Shinkujochakuyo johatsugen rutsubo

Specification

1. Name of this Invention

CRUCIBLE AS EVAPORATING SOURCE FOR VACUUM DEPOSITION

2. Claim(s)

Crucible as evaporating source for vacuum deposition, having a lid positioned inside of the crucible which is an evaporating source for vacuum deposition, covering a material to be evaporated, wherein gaps are formed at the lid area contacting the side wall of the crucible so that the vapor can escape through.

3. Detailed Explanation of this Invention

[Technological Field]

This invention pertains to a crucible as evaporating source for vacuum deposition, capable of providing an evenly formed vapor-deposition film which is free from spitting.

[Conventional Technology and its Problems]

When vapor deposition is conducted using the conventional crucible as evaporating source as shown in Fig. 1, if the evaporating material is heated to the temperature exceeding its boiling point under the atmospheric pressure, vapor is formed at the lower area of the surface as well, causing bubbles **A** to rise towards the surface **S** as shown in Part (a) of Fig. 2. Part (b) of the figure is a diagram illustrating the condition when the bubbles reach the surface; Part (c) of the figure is a diagram illustrating the condition when the bubbles burst at the surface to create fine particles **B**; and Part (d)

of the figure is a diagram illustrating the condition when fine particles reach the substrate surface to create protrusions on the film surface L. This phenomenon is called as "spitting" which is an unavoidable problem for the conventional crucible. That is, as long as the conventional crucible is used, although the degree of spitting varies, the obtained vapor-deposited film does not have a uniformly flat and smooth surface, but rather forms a rough surface with particle spots scattered over the surface.

[Object of this Invention]

This invention was developed to improve the abovementioned problem of the conventional crucible. The object of this invention is to provide a crucible as evaporating source for vapor deposition, which can prevent forming the rough surface of vapor-deposited film caused by spitting.

[Operational Examples]

Hereafter, this invention is explained based on the operational examples with reference to figures.

As shown in Fig. 3, a round lid 3 having gaps 4 is put in a conventional crucible 2, and a material 1 to be evaporated is placed under the lid 3. When the crucible is used as the vapor-deposition source, most of particles produced from the material 1 by spitting during vacuum deposition are captured by the lid 3. On the other hand, the material to be evaporated wets the inside wall of the crucible and lid with its surface tension (see 5 in the figure). As

a result, the evaporation surface consists of the areas from the outside of the lid to the inner wall of the crucible above the lid.

Hence, the crucible structure (shown in Fig. 3) of this invention not only prevents spitting but increases the vapor deposition speed sufficiently, as there is no lost evaporation area. Furthermore, since the structure of the crucible of this invention is extremely simple, the crucible does not require cost-increase compared with the conventional crucible.

As practical application, a lid (diameter = 13 mm) was placed at the location which is 20 mm above a V-shaped crucible (opening diameter = 20 mm; depth = 70 mm) shown in Fig. 3. Then, 10 g of Ga were charged. As the gaps of the lid, cuts (2 x 2 mm each) were formed. Also, PBN was used as the crucible material and lid material. Moreover, after the As source was prepared as well, GaAs was vapor-deposited epitaxially over the GaAs (001) substrate surface at 700°C. As a result, a film with mirror surface which was free from spitting was obtained at the deposition speed of 1 - 3 $\mu\text{m}/\text{hour}$. As for the evaporation source temperature for this process, it was 1100 - 1250°C for Ga and 355 - 370°C for As.

[Another Operational Example of this Invention]

Note that the shape of crucible is not limited to the V-shape as shown in Fig. 3, as the shape other than the V-shape (see Fig. 4) can provide the same effectiveness. However, in this case, several support parts 6 must be provided for preventing the lid from falling.

4. Simple Explanation of the Figures

Fig. 1 is a diagram of conventional crucible. Fig. 2 is a diagram for explaining the spitting phenomenon. Figs. 3 and 4 are diagram for explaining the operational examples of this invention.

1...Material to be evaporated; 2...Crucible; 3...Lid; 4...Gap;
5...Evaporated substance elevated due to its surface tension;
6...Support for lid.

Figure 1

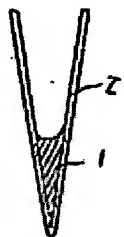


Figure 2

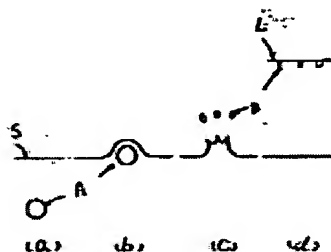


Figure 3

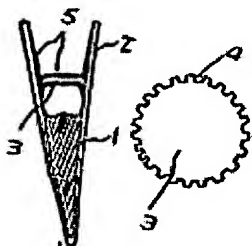


Figure 4

